Foreword for "From the Horse's Mouth: Career Insights from Working Zoologists"

Seminar held in 2006 by Royal Zoological Society of NSW in their series of student forums and workshops.

"From the Horse's Mouth: Career Insights from Working Zoologists" was an exciting, lively and very well-attended event held one Saturday in 2006 in the big lecture theatre at Taronga Zoo. The aim of the day was to provide students studying zoology with a diversity of career options presented by working zoologists. There were six presentations in all, in careers spanning academia through zoo education to public service and private sector zoology consultant. The presentations were all of a very high standard, each of the presenters conveying their considerable passion for what they do. The overall message was that a career in zoology will not make you a millionaire but it will give you enormous job satisfaction and life long enjoyment.

The four manuscripts that have eventuated provide an excellent "flavour" of the day. The first of these by Drs Matt Hayward and Adam Munn explores the PhD/Postdoc, or academic option; the second by Dr Martin Predavec, the private sector, professional zoologist option; and the third, by Catherine Price the public service option. These three cover a very wide spread of careers which a training in zoology might get you. Moreover, each one covers all the important details that an aspiring zoologist would need to have in order to evaluate whether or not that particular option is for them. They also give appealing and often amusing accounts of the authors' personal experiences. The fourth manuscript resulting from the day covers the workshop held after lunch, which put the participants into smaller groups in order to brainstorm the pros and cons primarily of current tertiary curricula in undergraduate zoology degrees and programs for postgraduate study.

Matt and Adam are both very enthusiastic about their chosen career as academics; about the exotic places it can get you to and the exciting projects, largely of your own choosing you can undertake. They discuss the ups and downs and twists and turns of any research program. They stress the importance of publishing their research – 'publish or perish'. In fact, they pull no punches about the conditions, both for living and for pay but they left the audience in no doubt that despite all apparent short-comings, they had made the right career choice for themselves.

Catherine presents a very different angle on the life of a professional zoologist. She is a senior threatened species officer in the Department of the Environment and Conservation. This career option gives Catherine a very strong work ethic about 'making a difference'. Again, she details what this job entails and the work is not easy but very satisfying.

Lastly, Martin presents a very comprehensive guide on how to become an environmental consultant, with particular emphasis on animals. Like Matt and Adam and Catherine, he explains how important an ability to write clearly, concisely, accurately and often is. Interestingly, this is a recurring theme with each of the presenters who provided a written chapter in addition to the spoken presentation on the day.

The piece provided by Dieter Hochuli and Peter Banks on the student's perceptions of zoological tertiary education resulted from afternoon workshops at previous Royal Zoological Society Student Forums, being "Transitions and decisions: Navigating career paths in zoology" in 2002 and "Prospects and pathways: creating opportunities for zoological careers" in 2004. The ideas synergized by Hochuli and Banks were reiterated in the 2006 student workshop and they provide a very insightful piece that should be compulsory reading for all commonwealth Minister's of Education, in addition to the university staff involved in the education of zoologists in the making, and what the expectations of their prospective employers will be.

All in all, I know that this forum and its written outcome is, and will continue to be, of enormous help and value to prospective zoologists, their educators, and the policy makers well into the future.

Jean Joss
Professor in Biological Sciences, Macquarie University
Contributor on the day
Life long passionate zoologist

Lions, leopards and muskoxen: a (very) light-hearted look at the ups, downs, ins and outs of a postdoctoral career through the eyes of two zoologists

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ABSTRACT

This paper arose out of a seminar series for the *Royal Zoological Society of New South Wales'* 2006 student forum and workshop, "*From the Horse's Mouth: Career Insights from Working Zoologists*". The paper is aimed mainly at honours and postgraduate zoologists, and describes our experiences as postdoctoral researchers, including what postdoctoral research is, how we got to be there (a PhD is essential), whether it was what we hoped it would be (a resounding yes), a brief summary of some postdoctoral highlights (MWH researched lions in Africa and AM muskoxen in Alaska), and of course some lowlights (low income, short-term positions and a lack of employment security). We follow up with a few recommendations on how to attain the lofty heights of a postdoctoral research scientist.

Key words: research; postdoctoral; careers; academia; zoology

What is a postdoctoral scientist?

A postdoctoral scientist (or postdoc) is a researcher who has recently completed a PhD and is on the path to a full-time academic and/or research career (Haak 2001). MWH conducted his PhD on the conservation ecology of the quokka (Hayward 2002) and AM did his on the ecophysiology of marsupial youngsters (Munn 2003). On average, only around one-quarter of PhD graduates will go on to postdoctoral studies (Regets 1998). Postdocs may or may not have further academic aspirations, but most do, and hence they are usually seeking further research training, and opportunity to broaden their scientific connections and to build a research portfolio. Postdoc positions are by their nature temporary (Haak 2001), usually ranging from six months to five years. Postdocs are considered essential for the ongoing research success of supervisors and collaborators and for institutions as a whole. They do not normally include formal teaching requirements, but most offer excellent opportunities for lecturing experience. In many ways, postdoc positions are the first opportunity for early career researchers to "spread their academic wings" by following their own ideas, although this varies depending on host country, host (supervisor) and institution. Regardless, postdocs are often a major driver in the research base of institutions and are most certainly expected to publish their results (Regets 1998), and perhaps have a little fun along the way.

Our career goals

MWH would like to retire and write two definitive books: the first on why some species go extinct and others remain secure; and the second on why some individuals are killed by predators and others survive. To achieve this, MWH has set about studying threatened species and predator-prey interactions in Australia, where introduced predators are devastating native species, and in the ecologically-intact ecosystems of Africa.

AM plans to continue research in the area of ecophysiology of mammalian herbivores, with particular reference to differences between juvenile and adult animals, and its impacts on life-history and demography. To achieve this, AM has developed a research program that focuses on quantifying the field energy and water needs of large marsupial and domestic herbivores in relation to age, growth and reproductive state. This information will be used to manage grazing pressures in Australia's arid and semi-arid rangelands and to develop appropriate responses to climate change trends in an effort to protect the economic and ecological sustainability of these important landscapes.

Our postdoctoral experiences

MWH - Postdoc 1: University of the Transkei (Unitra; now Walter Sisulu University), South Africa

MWH's first postdoc involved investigating the impact of bushmeat hunting (poaching) on threatened rainforest fauna in the Transkei, South Africa. This position was obtained by applying to an advertisement on a website before completing his PhD. The National Research Foundation of South Africa (NRF) funded the bushmeat project, which was aimed at comparing the ecology of key threatened species (the blue duiker *Cephalophus monticola*, bushbuck *Tragelaphus scriptus*, and bushpig *Potamochoerus porcus*) in the Dwesa/Cwebe Nature Reserve and in the surrounding forests, which are governed by local communities. Upon arrival, however, the project changed, largely because the locals deemed the surrounding forests too dangerous for fieldwork. Changes to prescribed postdoc projects are not uncommon and many develop beyond initial expectations, so be prepared.

The revised postdoc project concerned the impact of poaching on threatened species inside conservation areas. During this project, MWH was based at Unitra in Mthatha, sleeping on the floor of the maid's quarters (conspicuously lacking in maids) of a house shared by various zoologists. The major field component of the project involved conducting walked transects along a grid through the Dwesa/Cwebe Nature Reserve. Along each transect, evidence of the relative abundance of large mammalian fauna was collected from footprints, faeces, animal calls and direct observations (Hayward *et al.* 2005). While in the field, MWH and up to three field assistants lived in a small shack beside the Wild Coast beach and drank beers in the local shabeens (highlight!). The project was planned to continue for two years, but a six-month delay in payment led MWH to seek a more secure position elsewhere in Africa, and MWH's second postdoc was born.

Clearly, the changes and ultimate departure from the project was disappointing, however this postdoc was beneficial to MWH's long-term career by getting him to Africa, introducing him to some fantastic contacts and collaborators, and has resulted in one published paper and data for another.

MWH - Postdoc 2: University of Port Elizabeth (now Nelson Mandela Metropolitan University; NMMU), South Africa

MWH's second postdoc position researched the reintroduction of large predators to South Africa's Addo Elephant National Park. MWH found this position after he met Professor Graham Kerley from NMMU at a conference for the Zoological Society of Southern Africa in Cape Town. Professor Kerley was actively searching for someone to research the predator reintroductions in Addo (tip: go to conferences!).

The predator reintroductions included lions *Panthera leo*, spotted hyaenas *Crocuta crocuta* and a leopard *P. pardus* (Hayward *et al.* 2007a). Each predator was radio collared and fieldwork involved locating individuals daily, observations of home range, habitat use, diet, intra- and inter-specific interactions and competition. Continuous 96-hour animal tracking was used to determine hunting success and prey encounter rate by these large predators. Predator tracking bouts involved living (eating, sleeping, and abluting) in a 4WD vehicle supplied by Budget Rent-a-car, and, although onerous, the fieldwork yielded some truly most amazing experiences (Figure 1a). The predators soon accepted the research team without altering their behaviour and allowed us to drive within 5 m without moving, and often without even waking. The animals also calmly urine marked our vehicle, dragged kills into its shade, sniffed our heads while we slept, hunted alongside us and playfully chased the vehicle when it drove off. Still, sacrifices were made, particularly with respect to accommodation between field trips. At Addo's staff village, housing was far more salubrious than at Unitra, and consisted of a 3m x 4m non-insulated wooden hut, with an asbestos roof that leaked in the rain and cooked in the heat. These huts are so small they are nicknamed 'Wendy huts', because only Peter Pan and Wendy could live inside. MWH and his wife spent two years living in their Wendy hut.

Figure 1a. MWH with Kamqua the lioness. Photo: S. K. Moore

MWH wrote grants that supported him and assisted with project costs. He also gave talks at conferences and to the broader public. The research team was organized by MWH, and involved numerous volunteers. This research also developed a new line of enquiry when the park managers identified information deficiencies about what lions would eat and how many predators the park could sustain (Hayward *et al.* 2007b, Hayward *et al.* 2007c). As his collaborator, Professor Graham Kerley, had little experience with large predators, MWH had complete autonomy as to the direction of the research. This was enormously beneficial as it ensured MWH scientific development and growth. The problem of not fitting into a larger research team is that you don't benefit from being included on high impact papers written by a more experienced and well-known authors with a reputation in the research field.

AM – Postdoc: Institute of Arctic Biology, The University of Alaska, Fairbanks, Alaska USA.

AM's postdoc position was hosted by the Institute of Arctic Biology, The University of Alaska, Fairbanks, and was conducted at the R.G. White Large Animal Research Station (LARS). The position included a substantial teaching component, but allowed for around six months of dedicated research. The primary aim of the research was to compare the biology of juvenile and adult muskox (*Ovibus mushatus*). Like many large mammalian herbivores, muskoxen show high rates of juvenile mortality, particularly during their first winter, with implication for their overall population dynamics.

During his posdtdoc AM lived at LARS, kindly sponsored by Institute of Arctic Biology. The research station had excellent facilities for living ('the Earth Watch Cottage') and for research (animals, paddocks, barns, on-site laboratory, observation towers and weather station), but there were some drawbacks, such as an outdoor toilet. Of course, coming from a country that has an odd affinity for the outback dunny, AM would not normally have balked at the situation, but in Sydney, Australia, winter temperatures do not regularly fall below -30°C! There was one notable benefit to braving the cold, donning four layers of clothing, wrestling on a pair of gigantic rubber boots and trudging off through the snow to go to the loo, and that was to witness the Aurora Borealis (The Northern Lights) – a truly memorable experience.

AM's research investigated the behaviour, feed intakes and surface temperatures of juvenile and adult muskoxen at LARS (Figure 1b). Like the red kangaroos in Australia, juvenile mortality in muskoxen is typically higher than that of adults, especially during harsh winter conditions (Reynolds 1998). Therefore, with a bunch of hardy volunteers, the animals were observed 24 hours per day over two weeks in mid-winter (January) at LARS, with average temperatures of around -30°C and 2-4 hours of twilight each day (no real daylight at that time of year). Working in such an environment was certainly challenging, but it was an unparalleled experience and provided opportunity to work with and see some fascinating animals, including the muskox, moose, caribou, reindeer, bear, woodchucks, sandhill cranes and many others. The results from this research have underlined commonalities in the vulnerability of juvenile herbivores, irrespective of climate. For example, as with red kangaroos (Munn and Dawson, 2001; Munn and Dawson, 2006), nutritional constraints and relatively higher energy demands of juvenile muskox appear to explain their vulnerability relative to adults (Munn and Barboza, *In Press*).

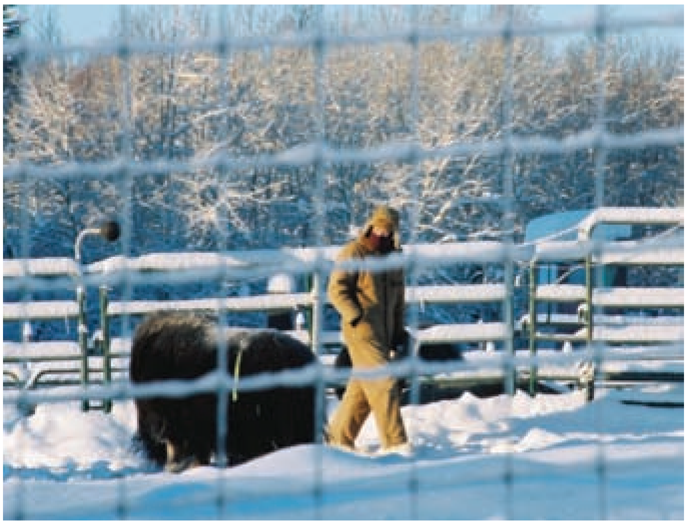

Figure 1b. AM waiting for muskoxen to defecate a data point.

AMs postdoctoral experience was invaluable for building research connections and international experience, which is highly regarded by grant reviewers and potential employers. We suggest that if it is at all possible, graduates interested in continuing a research career should seek postdoc positions outside of their academic country of origin, and most certainly outside their PhD institution.

How did we become postdoctoral zoologists?

MWH - One way that graduate students can initiate and develop postdoc positions is to have their PhD reviewed by someone with whom they would like to work. For MWH, this was difficult. MWH had a long-held desire to research the biology of animals in the ecologically intact ecosystems of Africa. However, a PhD on the conservation-ecology of the quokka *Setonix brachyurus* (Hayward 2002) was not overly amenable to examination by African scientists. Consequently, MWH's supervisors (Dr Mike Augee, Professor Barry Fox and later Dr Peter Banks at the University of New South Wales) were unable to find suitable reviewers in Africa, and it was clear that the time had come for the hard sell. MWH sent out numerous letters to potential collaborators, in addition to applying for several postdoctoral positions (sourced mainly via the internet and advertised through relevant societies, see Table 1). Eventually, persistence paid off and MWH was offered his first postdoc position at Unitra, South Africa (tip: never be afraid to cold call or email, most academics are very happy and willing to help; in fact, most are just happy that someone is reading their papers!).

AM - "How did I get here?" That is a question that often arises as a PhD student, and sometimes as a postdoc. For AM, the question of "I wonder how that works?" has been the driving force behind most career decisions and, consequently, a postdoc position was a logical path following a doctoral degree in Zoology. However, it is extremely important that the questions you are trying to answer are genuinely interesting for you. Long work hours are expected, often at remote and challenging field locations, and so a driving interest in the questions you are asking is crucial if you are to follow a research path. Standing up to your knees in snow at -40°C while waiting

Table 1. Societies that advertise postdoctoral research positions, have advice for potential postdocs or have numerous useful links to advertisements. This is far from a complete list, rather a place to start for postdoctoral job seekers. Searching university and academic's web sites is also be worthwhile.

Society	Web address
Royal Zoological Society of NSW	http://www.rzsnsw.org.au/
Zoological Society of London	http://www.zsl.org/info/jobs/
Ecological Society of Australia	http://www.ecolsoc.org.au/
Ecological Society of America	http://www.esa.org/
Society for Conservation Biology	http://www.conbio.org/
British Ecological Society	http://www.britishecologicalsociety.org/
Wildlife Conservation Research Unit, Oxford University	http://www.wildcru.org/
Animal Behaviour Society	http://www.animalbehavior.org/ABS/Announcements/
The Portal for Carnivore Ecology and Conservation	http://www.carnivoreconservation.org/dotclear/index.php
Primate Information Network	http://pin.primate.wisc.edu/jobs/list/avail
The Wildlife Society	http://www.wildlife.org/jobs/index.cfm

for an animal to defecate a data point would, we presume, be very unpleasant unless you really wanted to be there.

Contrary to MWH's experience, AM was able to find a marker for his PhD thesis who was a potential postdoc host; Associate Professor Perry Barboza (IAB UAF). This was in no small way due to networking by AMs PhD supervisor, Emeritus Professor Terence Dawson, University of New South Wales (tip: if research is your thing, you should be thinking about postdocs by at least halfway through the 2nd year of your PhD, and you should consult your supervisor about directions and connections). Importantly, AM also met with P. Barboza at an international conference and corresponded for around 12 months before journeying to Alaska (tip: go to conferences. And another tip, go to conferences!). As with a successful PhD, a good working relationship with a postdoctoral host can be crucial to your research and career path, so take the time to get to know your potential host, their work and their institution. Don't be afraid to contact their former and current students, it will give you a much better idea of what you are in for, and possibly help with your career decisions.

What were the jobs highlights?

Perhaps the biggest highlight of being a postdoc is the intellectual independence, but this may be heavily dependent upon your collaborator/supervisor. If possible, having the freedom to develop your own research program and to investigate the questions that you want to answer is among the most satisfying challenges. However, many postdoc positions are tightly focussed according to the supervisor's goals and funding stipulations. Nonetheless, postdoc positions should be marked by intellectual freedom and opportunity to explore your own ideas. Another attraction of postdoc positions is the opportunity to interact with other scientists and like-minded students. These relationships can lead to fruitful collaborations and, notably, further opportunity to explore your ideas on an international level. Some specific highlights from our postdoctoral experiences include (yes, these are gratuitous and unrelated to the actual postdoc, but they were a heck of a lot of fun!):

MWH - He met his wife! Witnessed lions and hyaenas hunt, mate, mark territories, fight, eat, sleep and defecate at very close quarters. Once, a lion sniffed MWH's head while he slept, and elephants and rhinos frequently charged him. Watching, but not smelling, sunrise over the steaming carcass of a fresh lion-killed kudu was strangely memorable. Lastly, MWH travelled the great national parks of southern Africa and 'starred' in a documentary on Addo Elephant National Park's predator reintroduction program.

AM – Experienced one of the most dramatic landscapes on the planet, where daylight changes by up to 7 minutes each day and people still go out for coffee at -40°C. AM has been charged by muskoxen and fed reindeer at Christmas (of course they were Santa's!). But perhaps the biggest highlight was the chance to fish Prince William Sound and to enjoy a 'Bligh Island Sunrise' over glacial ice.

Job lowlights? Yes, there were (are) a few.

The short-term nature of postdoc positions is arguably the most profound lowlight, offering little security beyond even one year in some cases. In particular, the NRF and Australian Research Council (ARC) postdoc positions are a maximum of three years. Importantly, eligibility for ARC postdoc positions is valid for a maximum of three years post-graduation from a PhD. Therefore, if a research career is your chosen path, it is extremely important that you organise a postdoctoral position as soon as possible during your doctorate, preferably before you graduate. Postdoctoral positions can take a long time to organise (e.g. > 12 months for MWH and AM), and so they must be planned well in advance. Moreover, plan for all contingencies, and especially for unforseen circumstances that may arise even after an application has been submitted (e.g., a new wife's two celebrated but unplanned pregnancies - MWH).

The lack of a defined career path for postdocs can be problematic. For example, in the private sector employees are actively fostered along the corporate ladder, but in academia PhD students are discouraged from continuing work at their graduating university, leaving many unsure of their career paths. Less than 20% of graduating doctorates ultimately obtain an academic appointment (CDCIRTCLS 1998, Regets 1998), making postdoctoral research a rather poorly defined and insecure path. For example, web searches for conservation and ecology positions between June and October 2006 revealed 226 advertisements worldwide (Fig. 3). Of these, the vast majority were microbiological and/or genetics based (Fig. 2). There were just 26 positions that were field-based positions in ecology, and of these only two related to mammals (Fig. 2). In short, taxonomic bias can seriously curtail your prospects. Importantly, it is *never* too late to change a research direction and, contrary to common misconceptions, you are not locked into the research area in which you gained a PhD. Indeed, numerous granting bodies actively encourage disciplinary diversification, particularly at the postdoctoral stages (see Table 2 for societies and contact your University's Research Office).

In addition to a lack of job security, a conspicuous level of near-poverty can be common for postdocs, and especially for zoologists. MWH earned a staggering AUS$122,000 between 1998 and 2006, or equivalent to AUS$15,250 annually for eight years (i.e. four years PhD plus four years of postdoc positions). AM earned around AUS$20,000 for his 12-month appointment in Alaska. In Australia and other developed countries, postdocs can earn far more (e.g. AUS$55,000 - AUS$85,000), but this is a still lower salary package to that commonly offered to comparably trained persons in the private sector. The bottom line is, if you want to build an international research profile, experience in countries with limited resources (and hence funding) is common, particularly for zoologists. Moreover, some research areas, especially in conservation, are already well-advanced in developed countries (with well-paid postdocs) and can offer little opportunity, but there are plenty of opportunities in developing countries where financial support is limited.

Perhaps the final difficulty is the lack of advertised postdocs. Four months trawling through thousands of job advertisements on the Nature and UK Jobs webpages (Table 2), yielded only 226 ecological or conservation related postdoc or research associate position (Fig. 2). Of these positions, over 70% were related to molecular ecology, genetics, disease or immunology (Figure 2). In fact, only 26 were related to Chordates and only two were relevant to mammalogists (i.e. the authors; Fig. 3).

Recommendations for people thinking about a postdoctoral career

The first thing to do if you want to conduct a postdoc is to complete a PhD. Work hard at your PhD, take ownership of it because your efforts (in the field, in the lab or on the

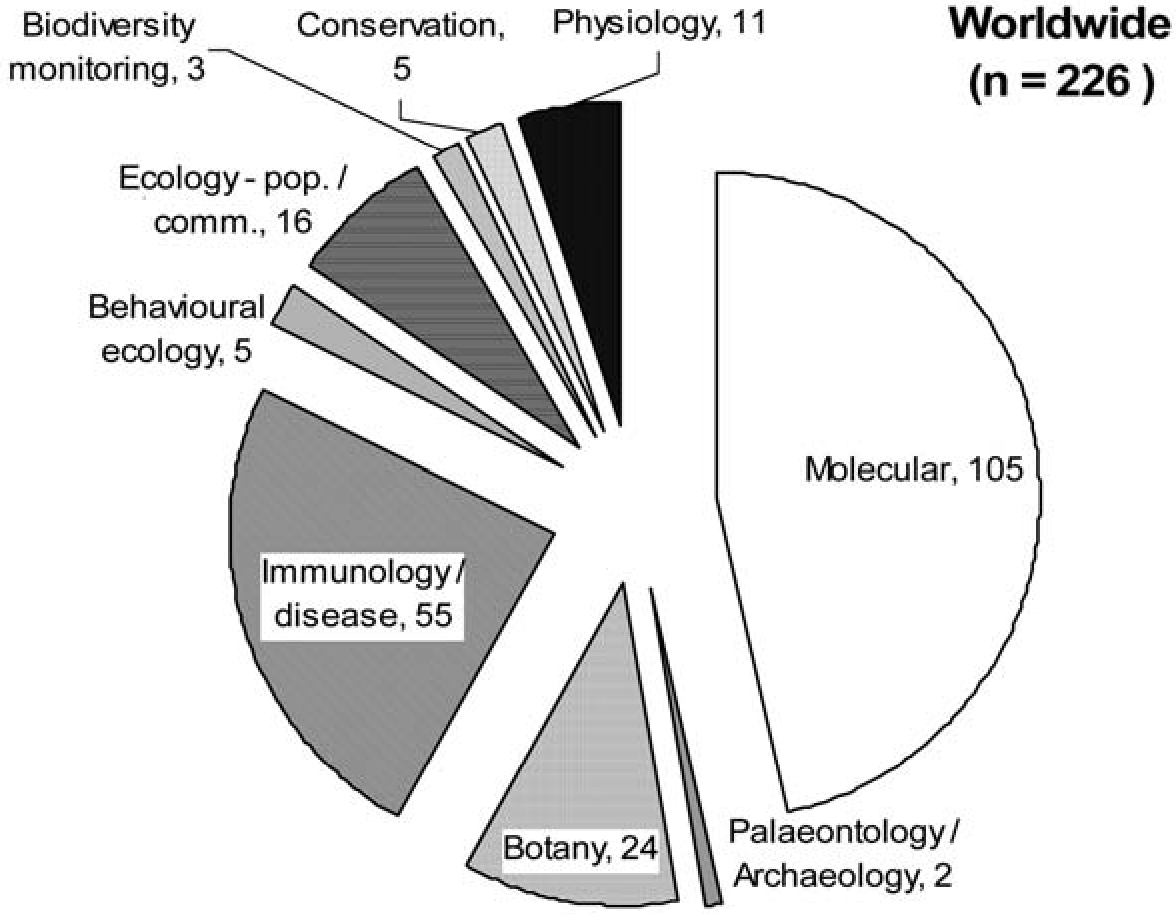

Figure 2. Postdoctoral jobs listed following keyword searches of *ecology* and/or *conservation* between 8/6/2006 and 22/10/2006 in the Nature and UK Jobs webpages (from Table 2).

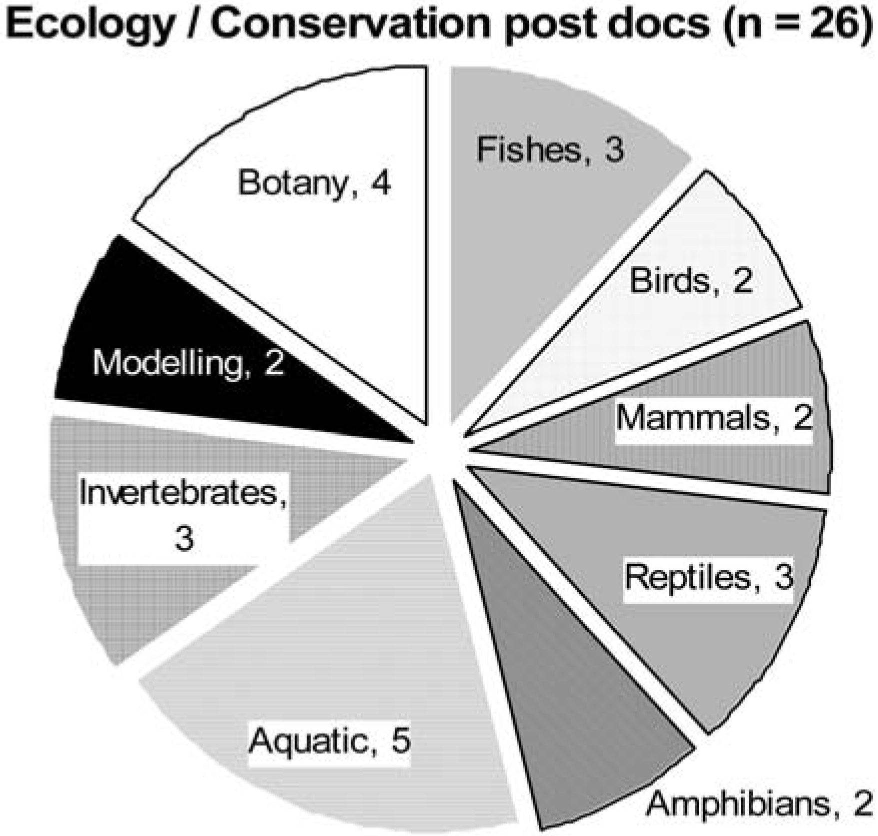

Figure 3. Breakdown of the 26 postdoctoral jobs related to chordate animals in the Nature Jobs and UK Jobs webpages (see Table 2) between 8/6/2006 and 22/10/2006.

Table 2. Jobs web sites that advertise postdoctoral research positions.

Group	Web address
UK Jobs	http://www.jobs.ac.uk/sector/biology/
Nature Jobs	http://naturejobs.nature.com/js.php
Post-doc jobs	http://www.postdocjobs.com/
Research Jobs Australia	http://www.researchjobs.net.au/
Top Higher Education Jobs	http://www.tedjob.com/
Seek	http://www.seek.com.au/
Find a postdoc	http://www.findapostdoc.com/search/index.asp
Western Australian Department of Environment and Conservation	http://www.naturebase.net/content/view/2425/1305/
New Scientist Jobs	http://www.newscientistjobs.com/splash.action/
NSW Department of Environment and Conservation	http://www.environment.nsw.gov.au/jobs/currvacs.htm
NRM Jobs	http://www.nrmjobs.com.au/

computer) will be rewarded, and prepare for poverty (at least in comparison to your non-researching peers) if you seek research experience outside the developed world. Also, don't think you have to be a complete 'brainiac' to do a PhD – MWH failed most of first year university through extended study breaks at the Uni Bar.

There are two strategies for selecting a postdoc. The first involves seeking a scientific 'heavyweight' in your field, writing them an application letter and hope they have something to offer. This might mean you are simply collecting field data for a supervisor, and if you have spare time you may be able to collect data for your own research. The benefit of this system is that the supervisor should include you on any papers that arise, and these are often in high impact journals. An alternative approach is to identify your own interests and find or develop a project to achieve them. Most postdoctoral supervisors welcome a potential candidate who comes complete with a full project design and plan of execution. Indeed, this approach yields the most educational benefits to you, although it may slow your rate of 'big' publications and therefore subsequent academic prospects.

If you do aim to develop your own research path, you may not be able to achieve this in one go, so work in steps to achieve your overall aim. You may not find the person/project immediately, but if you head in the right direction you are more likely to encounter them. For example, MWH aimed to research carnivore ecology, which ultimately arose through researching quokka conservation ecology, followed by research on the conservation threats of bushmeat hunting in Africa, and finally to work on large predator reintroductions.

Once you have decided which path to follow (and there are certainly more than the two primary examples presented here), send out letters to potential collaborators and hosts. Try to build a joint project that satisfies all stakeholders (e.g. granting bodies, host institutions), but one that is distinctly interesting to you. Alternatively, look for advertisements in newspapers and/or web sites of research societies (Table 1) and job agencies (Table 2). We do have a few words warning, however: try not to simply repeat your PhD. The aim of a postdoc position is to broaden your education, gain additional skills, make valuable connections, preferably internationally, and to include some teaching experience. But overall, a postdoc position should help you to develop and enhance your repertoire as a research zoologist, and perhaps have a little fun along the way.

Another option to get a postdoc and to secure others is to present papers at conferences. This will allow potential collaborators to hear of your work and allow you to develop contacts. Begin attending conferences as a PhD student (or even as an undergraduate). Clearly this requires a cashed up supervisor, particularly for overseas conferences. AM attended three national and one international conferences as a student. MWH attended three national conferences as a student and two South African, one European and one international conference as a postdoc. MWH obtained a travel grant to attend the international conference and recommends applying for all such grants.

Lastly, the ‘publish or perish’ paradigm applies as much to obtaining a postdoc as it does to other academic pursuits. It is important to publish papers early in your PhD, and preferably in high impact journals in your field. Indeed, if you’ve used animals in your research you have an ethical responsibility to publish your work in a timely fashion. Early publication can be achieved by submitting a literature review as a full manuscript, and getting involved with other research in your Supervisor’s laboratory can be beneficial in this respect, provided you make a genuine contribution. Maintaining a good publication rate is essential to securing postdoc positions.

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